

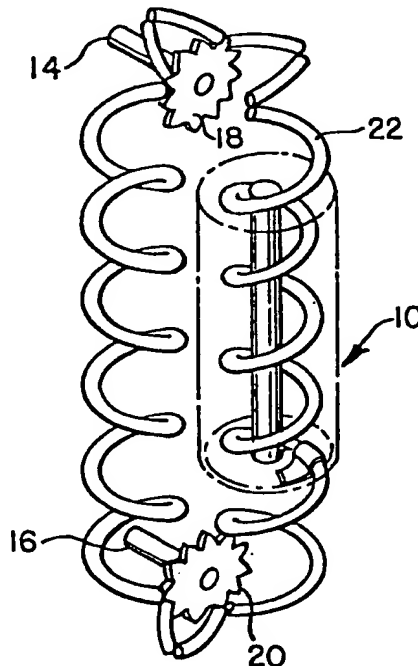
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**(54) Title:** POWER GENERATOR UTILIZING BUOYANCY OF A BODY IN A LIQUID**(57) Abstract**

Power generating apparatus which derives its motive power from the buoyancy of a body immersed in a liquid medium. The apparatus includes an endless, flexible, spiral pipe (22) trained about respective upper and lower sprockets (18, 20), the pipe positioned so that a portion of it passes vertically through a column of liquid medium (12) in a container (10). The pipe (22) is lighter in weight than the weight of the liquid medium (12) displaced by the pipe so that the buoyancy of the pipe (22) causes the pipe (22) to travel and rotate the upper and lower sprockets (18, 20). Sealing means (36) are provided at the lower end of the container (10) of liquid medium (12) to prevent loss of the liquid medium (12) from the container (10) while permitting passage of the spiral pipe (22) vertically there-through.



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DescriptionPower Generator Utilizing Buoyancy of a Body in a Liquid5 Technical Field

This invention relates to an apparatus which derives its motive power from the buoyancy of a body immersed in a liquid medium.

10 Background Art

Numerous devices have been proposed which make use of the buoyancy of a body immersed in a body of liquid to derive power therefrom. U.S. Patent No. 29,149 discloses an endless chain of buckets traveling about suitable pulleys, 15 the buckets immersed in a body of water. Steam is introduced into the buckets below the surface of the water to displace the water therefrom and render the buckets buoyant so as to give motion to the chain of buckets. Grondahl, U.S. Patent No. 2,037,973, discloses a series of floats positioned on an 20 endless belt which travels through a column of water, the buoyancy of the floats causing the belt to rotate. Platt, U.S. Patent No. 2,135,110, discloses an endless chain to which buckets are attached, the chain trained around upper and lower sprockets immersed in a body of water. Means are 25 provided to inject air under pressure into the buckets during the time they are inverted in the water to give them sufficient buoyancy to drive the chain. Baumgartner, U.S. Patent No. 3,194,008, discloses a buoyant ring partially submerged in a body of liquid, the buoyant ring having a series of indi- 30 vidual sealed compartments. The buoyant force of the sealed compartments causes the ring to rotate. Gilmore, U.S. Patent No. 3,857,242, discloses use of hollow, closed tanks to effect movement of a pair of conveying belts by both gravity and buoyancy. Conn, U.S. Patent No. 3,918,827, makes use of 35 collapsible buckets connected to an endless chain submerged in a lake or sea. Diamond, U.S. Patent No. 3,934,964, discloses placing buoyant cylinders on one side of a rotatable member and sinking cylinders on the opposite side.



Disclosure of Invention

It is a primary object of this invention to provide a power apparatus making use of the buoyancy of members immersed in a liquid to move an endless belt.

5 It is another object of this invention to provide a power apparatus making use of an endless buoyant belt partially immersed in a body of liquid, the buoyant belt vertically entering the body of liquid through a rotatable seal.

Another object of this invention is to provide a  
10 power apparatus utilizing an endless, flexible, spiral hollow column of foamed polystyrene or other material as a buoyant member.

These and other objects are accomplished by use of a power generator apparatus comprising a container holding a  
15 column of liquid medium, upper and lower rotatable shafts above and below the container, pulleys journaled on the upper and lower shafts, an endless, flexible, spiral buoyant member passing around the upper and lower pulleys and positioned such that a portion thereof passes vertically through  
20 the column of liquid medium in the container so that the buoyancy of the spiral member causes it to travel upwardly through the column and rotate the upper and lower pulleys. Sealing means are provided at the lower end of the container  
25 of liquid medium to permit passage of the spiral member vertically therethrough into the container of liquid medium while preventing loss of the liquid medium.

Brief Description of the Drawings

Fig. 1 is a perspective view of the power generating apparatus of this invention.  
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Fig. 2 is a vertical cross-sectional view of the container holding the liquid medium, the rotatable seal at the lower end of the container and the spiral buoyant member passing therethrough;

35 Fig. 3 is a cross-sectional view along section line 3-3 of Fig. 2; and



Fig. 4 is a partial view of the spiral member illustrating the manner in which it may be hinged to allow it to bend about the upper and lower sprockets; and

Fig. 5 is a partial view of the spiral member illustrating the manner in which it may be connected to allow one section of the spiral member to pivot relative to an adjoining section.

#### Best Mode of Carrying Out the Invention

Referring to the drawings, particularly Fig. 1, the power generating apparatus disclosed includes a container 10 of any desired form holding a liquid medium 12. The liquid medium is generally water; however, other liquids may be used. The greater the density of the liquid the greater the buoyancy, since buoyancy is a function of the weight of the fluid displaced by the buoyant member. Shafts 14 and 16 are provided above and below the container 10 as illustrated. Sprockets 18 and 20 are journaled, respectively, to the upper and lower shafts. An endless, flexible, spiral belt 22 is trained around the upper and lower sprockets which are disposed one above the other so that a portion of the belt passes through the column of liquid 12 in the container 10. The spiral buoyant member 22 causes the endless belt to travel and rotate the upper and lower shafts 14, 16 and sprockets 18, 20. Preferably the buoyant member 22 is a flexible, hollow spiral column of foamed polystyrene, although other foamed plastics and other flexible materials may be used.

It may be necessary to hinge the buoyant member at predetermined intervals as illustrated in Fig. 4 to allow the sections of the buoyant member 22 to bend relative to one another about the top and bottom sprockets 18, 20 or to connect sections of the buoyant member together at spaced intervals so that one section is free to rotate relative to the adjoining section as illustrated in Fig. 5. The hinge 24, as illustrated in Fig. 4, allows the buoyant member to separate about the pivot point of the hinge. Preferably the hinge is flush with the exterior surface of the member 22

and concealed so as not to create any undue friction as the buoyant member travels upward through the sealing member at the lower end of the column of liquid 12, as will be discussed. The ends 26 of the hinge which are exposed on bending of the buoyant member 22 at the hinge 24 are sealed to prevent entry of the liquid thereinto. Illustrated in Fig. 5 is an alternative means of connecting the sections. Pins 27 are inserted in the ends of the respective sections so that the adjoining sections are free to rotate relative to the pin.

Sealing means are provided at the lower end of the container 10 where the spiral buoyant member 22 enters the fluid medium. The sealing means functions to permit the spiral buoyant member 22 to enter the liquid 12 without loss of liquid from the container 10. The sealing member is best illustrated in Fig. 2 and comprises a plate 28 resting on bearing 30, preferably an air bearing, for rotation of the plate relative to the container 10. The outer peripheral edges of the plate 28 are closely fitted against the inner walls of the container 10 so as to prevent any leakage of liquid from the container. If necessary, an O-ring 32 may be used to seal the gap between the plate 28 and inner surface of the container wall. The plate includes an arcuate opening 34 as illustrated in Fig. 3, which permits the spiral buoyant member 22 to pass vertically through the plate 28 into the column of liquid 12 in the container 10. The radius and size of the opening in the plate 28 is chosen to fit the particular design of the spiral buoyant member used. Desirably, the buoyant member should not contact the side walls of the plate 28 as it moves through the opening into the column of liquid 12 in the container 10. A flexible seal 36 of rubber or other suitable material is fitted over the opening and secured thereto by rivets 38 or other means to effect sealing against liquid loss. The seal 36 skirts the exterior surface of the spiral buoyant member 22 as it moves vertically into the column of liquid 12 to prevent loss of liquid from the container 10. Movement of the buoyant member 22 upwardly through the opening in the plate

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28 causes the plate to rotate relative to the container. The sealing assembly is sufficiently light in weight and flexible so that the weight of the liquid in the container seals the edges 40 of the sealing member 36 against the exterior surface of the spiral, buoyant member 22 moving into the column of liquid so that there is minimal loss of liquid. It may be necessary to locate an idler roll 42 on the lower surface of plate 28 as illustrated in Fig. 2 to guide it into the opening in the plate.



Claims

1. A power generating apparatus, comprising:  
a container holding a column of a liquid medium;  
upper and lower rotatable shafts above and below the container;  
pulleys journaled on the upper and lower shafts;  
an endless, flexible, spiral member passing around the upper and lower pulleys positioned such that portions thereof pass vertically through the column of liquid medium in the container, the buoyancy of the member causing it to travel and rotate about the upper and lower pulleys; and  
sealing means at the lower end of the container of liquid medium permitting passage of the spiral member vertically therethrough into the container while preventing loss of the liquid medium.
2. The apparatus of claim 1 wherein the member is a hollow, spiral column of foamed polystyrene.
3. The apparatus of claim 1 wherein the member is hinged at predetermined intervals along its length to allow it to bend as it passes over the top and bottom pulleys.
4. The apparatus of claim 1 wherein the member is sectioned with the respective sections pivotally joined.
5. The apparatus of claim 1 wherein the sealing means includes a plate having an opening therein through which the spiral member passes upwardly, the plate positioned across the lower end of the container of liquid medium and mounted for rotation relative to the container so that as the spiral member moves vertically the plate is free to rotate, the plate having a flexible sleeve contacting the exterior surface of the member passing through the opening preventing passage of liquid medium between the member and the sleeve.





6. The apparatus of claim 5 including an idler wheel mounted on the lower surface of the plate to guide the spiral member into the opening.

7. The apparatus of claim 5 including a column of buoyant material having a specific gravity less than that of water secured to the upper surface of the plate to reduce friction between it and the container.

8. A power generating apparatus utilizing the buoyancy of a body immersed in a liquid medium to derive its power, comprising:

- a container holding a column of liquid medium;
- upper and lower rotatable shafts above and below the container;

- sprockets journaled on the upper and lower shafts;

- an endless, flexible, spiral, hollow column of foamed polystyrene passing around the upper and lower sprockets and positioned such that a portion thereof passes vertically through the column of liquid medium in the container, the buoyancy of the foamed polystyrene column causing the column to travel upwardly and rotate the upper and lower sprockets;

- a plate positioned across the lower end of the container holding the column of liquid medium having an opening therein through which the spiral polystyrene column can pass upwardly, the plate being free to rotate as the spiral column moves vertically through the container of fluid medium; and

- a flexible sleeve member fitted over the opening and contacting the exterior surface of the spiral column as it moves vertically into the column of liquid medium to prevent passage of the liquid medium from the container.

9. The apparatus of claim 8 wherein the liquid medium is water.

10. The apparatus of claim 8 wherein the spiral column is sectioned with the respective sections connected so that each is free to rotate relative to the adjoining section.



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11. The apparatus of claim 8 including an idler wheel mounted on the lower surface of the plate to guide the column into the opening.



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FIG. 5

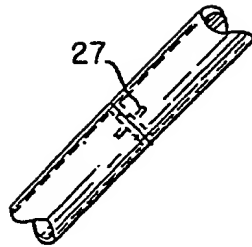


FIG. 1

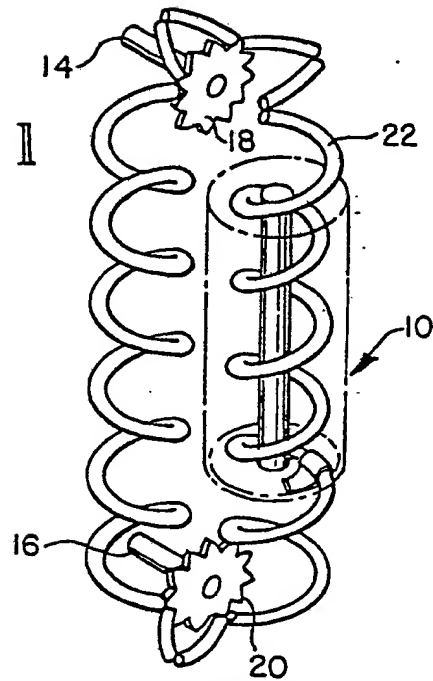


FIG. 2

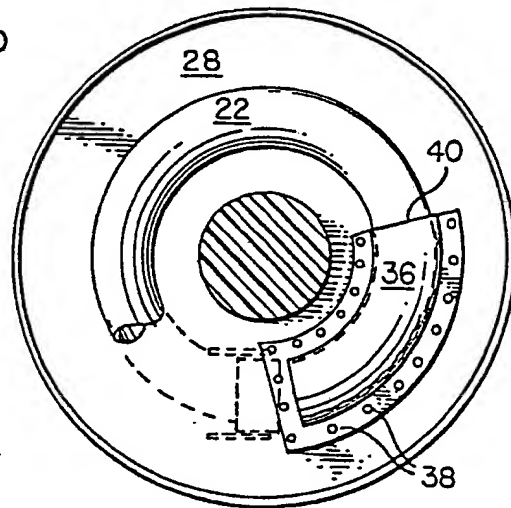
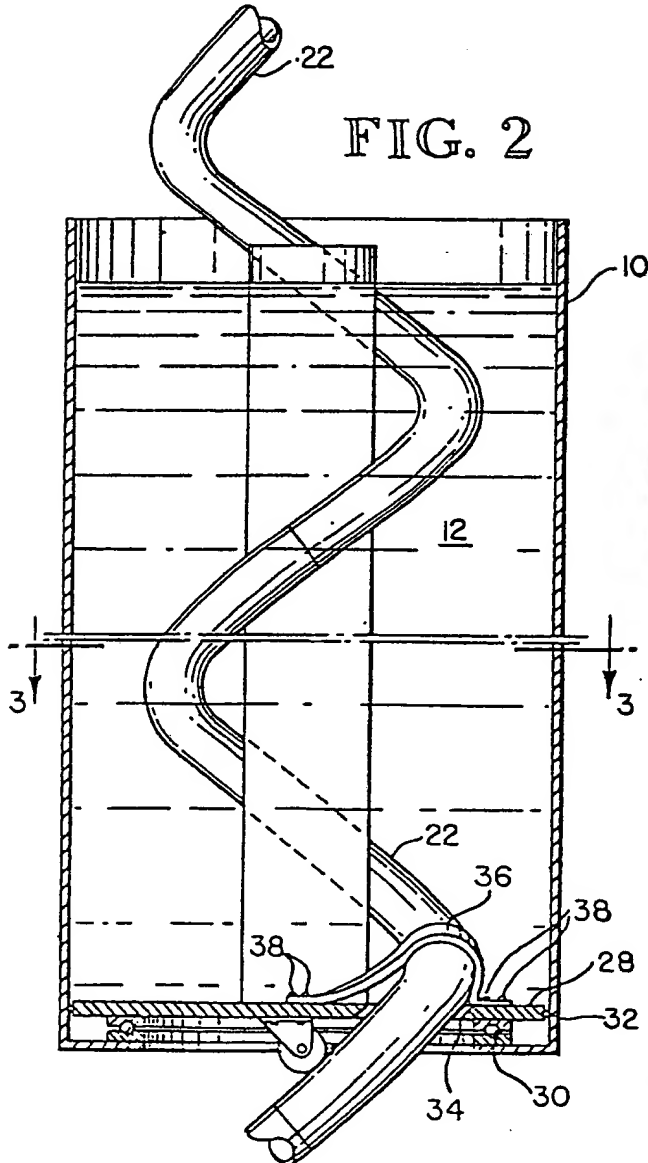


FIG. 3

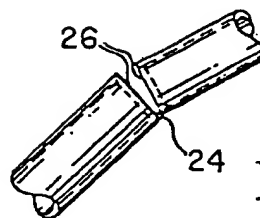


FIG. 4

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US80/01425

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|---|--|--|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>   |  |  |
| According to International Patent Classification (IPC) or to both National Classification and IPC   |  |  |
| INTL. CL. $\frac{3}{2}$ F03C 5/00   |  |  |
| U.S. CL. 60/495   |  |  |
| <b>II. FIELDS SEARCHED</b>  |  |  |
| Minimum Documentation Searched <sup>4</sup>   |  |  |
| Classification System   | Classification Symbols   |  |
| U.S.  | 60/495;<br>185/32;<br>415/7  |  |
| Documentation Searched other than Minimum Documentation<br>to the Extent that such Documents are included in the Fields Searched <sup>5</sup>   |  |  |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>   |  |  |
| Category <sup>*</sup>   | Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup> | Relevant to Claim No. <sup>18</sup>                              |
| A   | US, A, 1,708,807 Published 09 April 1929<br>TATAY  | 1-11   |
| A   | GB, A, 314,234 Published 27 June 1929<br>STEAD   | 1-11   |
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| Date of the Actual Completion of the International Search <sup>1</sup>  |  | Date of Mailing of this International Search Report <sup>2</sup> |
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